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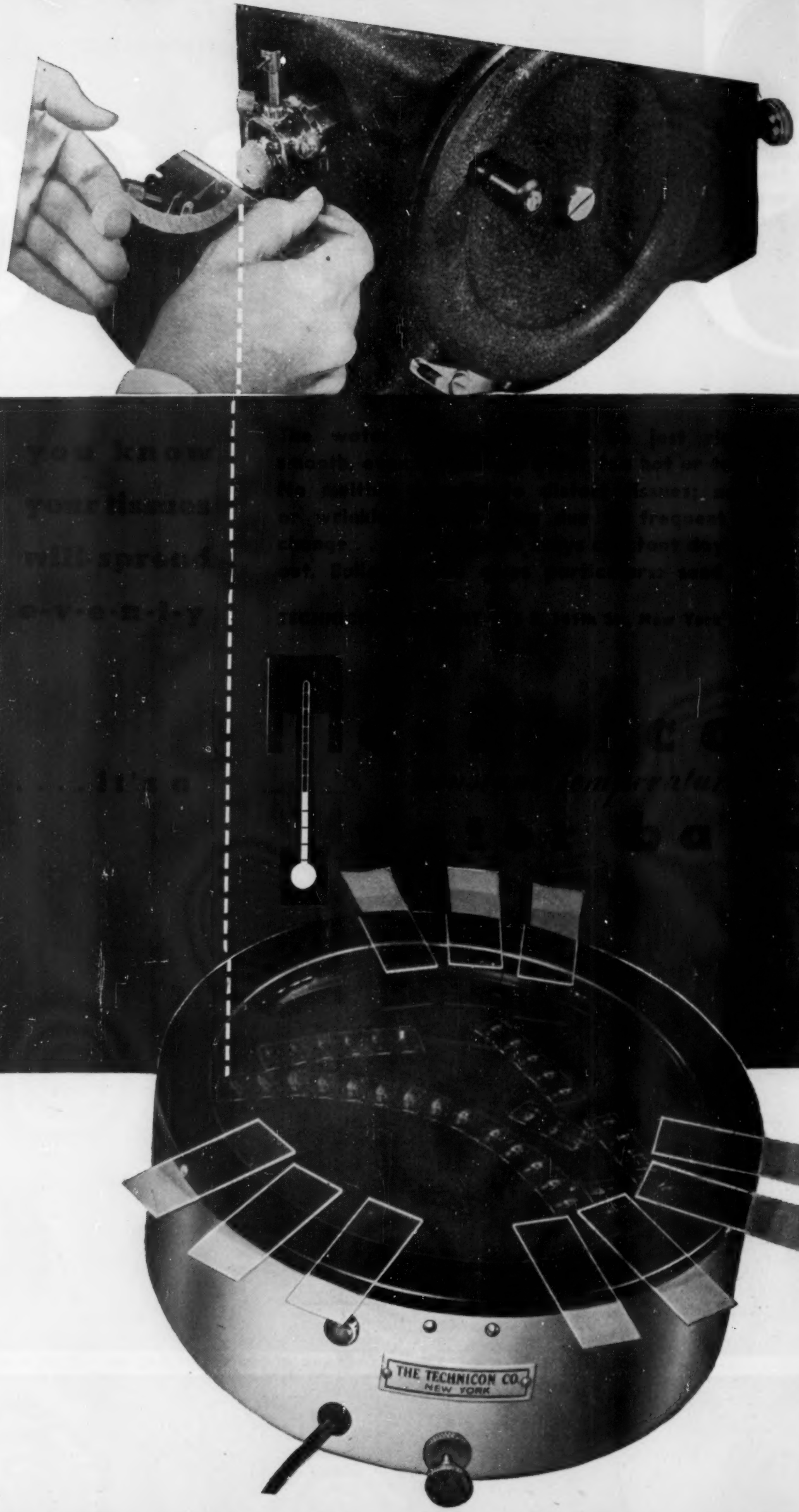
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Physics in Central and Southern Europe

Robert L. Platzman[1]

SCIENTIFIC ACTIVITIES IN BRITAIN, Scandinavia, and Western Europe are familiar to most American scientists, but unfortunately contacts with activities farther to the east are less extensive and far from satisfactory. It is therefore with pleasure that I report on some impressions and experiences of a recent visit in central and southern Europe. The following brief account does not attempt to describe all important activities in the countries mentioned, nor does it list all of the leading workers in any one place. The visits which my wife and I made were unofficial, and the choice of itinerary was dictated by practical and personal considerations. Moreover, the comments which follow pertain more to the conditions under which scientific work is being prosecuted than to the researches themselves.

Poland

Conditions in Poland do not permit the unrestricted entry of foreigners, and there are no facilities for tourists. However, it is claimed that anyone with a legitimate reason for entering the country will receive permission to do so. I had been invited to lecture at the University of Warsaw, and visas were issued with little delay. Travel to Warsaw is not difficult and one has the choice of comfortable international trains with sleeping cars from Sweden (via ferry) or from the west or south; air travel also connects most European capitals.

The Polish physicists were extremely friendly and hospitable, as were, indeed, all of the Polish people whom we met. We lived in Warsaw as guests of Prof. W. Rubinowicz, whom we had met at the September discussions in Copenhagen. Prof. Rubinowicz, in addition to a heavy teaching schedule and supervision of the research of a number of advanced students, is carrying on his own research in theoretical physics and writing two books, a monograph on multipole radiations and a textbook on atomic physics.

Prof. S. Pieńkowski, director of the Institute for Experimental Physics, placed a car and chauffeur at our disposal. He, like the other experimentalists, is severely handicapped in his work by the shortage of equipment, but we were told that the situation is gradually improving. The building which houses the physics institutes is intact, but all equipment and the entire library were carried off or destroyed by the Germans. Even the furniture was removed; not a chair or table was left. (Liquidation of the Warsaw physics institutes was under the supervision of the well-known German physicist, Prof. K. Diebner.) In the process of re-equipping the institutes, preference has wisely been given to equipment for teaching. We were much impressed by the high quality of this equipment, some of which was provided by UNRRA. The Institute for Theoretical Physics was completely destroyed. Its director, Prof. C. Bialobrzeski, now works in the single building that houses the institutes of Pieńkowski and Rubinowicz and, indeed, lives in a small room in the building. (The housing shortage in Warsaw is probably the worst in the world.)

At the conclusion of the war not a single physics book or periodical remained in any of the libraries of Warsaw—or what was left of them. This is a typical case, for all of approximately 150 institute libraries of the University were completely destroyed. The rebuilding of the physics library is proceeding well, but, although many recent books and periodicals have been acquired, replacement of older items is difficult. Funds are extremely limited, and much has been given by other countries, including an American contribution from the Rockefeller Foundation. Scandinavian countries have been particularly generous.

My lecture in the physics institute was attended by about 50 persons—professors, assistants, and students. Many questions were asked afterward, and English was generally spoken, usually well. After the lecture I met Prof. A. Soltan, who has worked at the California Institute of Technology and who is now constructing a high-voltage accelerator for research in nuclear physics.

I was also invited by Prof. W. Kemula, the director, to lecture at the Institute for Physical Chemistry. Prof. Kemula is dean of the Faculties of Sciences this year. Here again the lecture was attended by a large audience which seemed pleased to have close contact with an American scientist. Following the lecture we met several of the other chemistry professors and staff members. One of them, Prof. W. Swietoslawski, who was Minister of Education before the war, spent many years in America, where he is very well known. In a tour through the Institute we were impressed with its size and potential excellence.

[1] Guggenheim Fellow, Institute for Theoretical Physics, Copenhagen. On leave from Purdue University.

Only one wing was destroyed during the war. Unfortunately, there is very little equipment, for the building was stripped by the Germans and used as a military hospital. (Even the plumbing and electrical wiring were torn out.) Part of the building has been reconverted to laboratories, but it has been difficult so far to obtain research equipment. We were told of searches through ruins to recover pieces of small equipment, such as ringstands, that might be in usable condition.

From Warsaw we traveled to Cracow, where we were received by Mrs. Jan Blaton, wife of the late Prof. Blaton and herself a physicist. Prof. Blaton was working at the time at the Institute in Copenhagen, and we knew him well there. He was the country's leading younger theoretician, and his death on May 17 of this year in a tragic accident while on a holiday in the Tatra mountains was a severe loss to Polish physics.

The physicists in Cracow had a much less isolated feeling, for only a month earlier they had been hosts to the International Union of Pure and Applied Physics Symposium on Cosmic Rays. I lectured at the physics institute there and met a number of scientists. We had a particularly enjoyable conversation with Prof. Henryk Niewodniczanski, who is well known for his work in spectroscopy. We also met Prof. J. Weyssenhoff, but could not see Prof. K. Zakrzewski, who was very ill at the time. (Prof. Zakrzewski died a few months ago.) The Jagellonian University, as, indeed, the city of Cracow itself, which was the seat of the German "General Government" and enjoyed the advantage of having been chosen to become a "German" city, is almost undamaged. It was extensively mined near the end of the war and escaped destruction only because the end came so fast. Most of the physics equipment, however, was removed by the Germans. Profs. Niewodniczanski and Weyssenhoff told us of several trips they had made to Germany to search for this equipment, with only partial success. The library is intact, although sadly lacking in recent books and periodicals.

I should emphasize the strong impression we had of the vigor and determination with which the rebuilding of the University and the reconstruction of the city of Warsaw are being carried out. The horrible destruction in the city is well known; yet we, like all visitors to whom we have talked, were terribly shaken when we first saw it. The destruction of the University of Warsaw was without parallel in modern times: professors and students were murdered, buildings demolished, libraries burned, and equipment looted. One can have nothing but admiration for the spirit with which the Warsaw scientists have attacked the formidable task of reconstruction.

The Polish scientists feel isolated from American science, and this feeling is only partly diminished by the now fairly regular receipt of the principal American periodicals. It is a result both of their long period of complete isolation and of the paucity of personal contacts after the war, the last because few foreign scientists have traveled to Poland and few Polish scientists have been able to visit abroad because of the staggering shortage of teachers at home. (From 1939 to 1946, although the national population declined by 25%, the number of science students *increased* by 75%.) But as far as we could tell—and there was nothing to indicate that our impression was false—only the friendliest attitude prevailed toward American scientists. There is a tendency today to regard Poland and other central European countries as lying behind the "iron curtain," as has been indicated, for example, by Dr. L. Kowarski in his interesting remarks in the *Bulletin of the Atomic Scientists,* 1948, **4**, 139. Regardless of how true this might be with respect to their politics or economics, it is certainly not true in the case of their science. There is no iron curtain for science to the west of Poland. Polish scientists would all like closer contact with the West. Americans should be much more active in promoting such contact.

Czechoslovakia

We spent several weeks in Prague, just two months before the change of government. The surface of that unforgettably beautiful city is unchanged, but the scars of the German occupation are easily found. Plaques, usually decorated with fresh flowers, on hundreds of street corners commemorate the death of Czechs shot on the spot by Germans. (It is not easy for an American, or anyone who has lived in an unoccupied and undamaged country, to forget these plaques, which one can see from the Baltic to the Mediterranean. They may list a hundred names or merely one or two. They are a new common mark of the streets of Europe.) In almost all university buildings there is a memorial, with wreaths and flowers, to some professor or professors who formerly taught there and who were killed in Prague or died in a concentration camp.

In the Institute for Physics we were again shown the greatest hospitality. Prof. August Žáček, inventor of the magnetron, showed us the laboratories, and Prof. V. Petržílka, who is well known in England, helped explain the research work to us. Prof. Petržílka is engaged in cosmic-ray investigations using the new Ilford photographic emulsions. The plates are exposed in stations in the high Tatra mountains in northern Slovakia. Other fields of investigation in Prague are X-rays, electron microscopy, and ultra-

high-frequency radio. We also had a pleasant conversation with Prof. V. Trkal, director of the Institute for Theoretical Physics.

One of the most difficult problems in Prague, and also in Poland and Italy, is the greatly augmented number of students. This coupled with the wartime depletion in the teaching ranks—for example, in Warsaw fully half the teaching staff of the University was lost—has subjected the staff to a continual strain. One wonders how they have any energy left for research. Prof. Žáček told me that he regularly lectures to more than 1,000 students at a time.

Another problem met again in Prague is the shortage of equipment because of looting by the Germans. Although many things were stolen, the situation now is much better than that in Poland. The scientific libraries and buildings, which impressed us greatly, are intact. There is, however, a shortage of wartime and postwar literature.

In Prague I spoke before the physicists and the physical chemists. Both lectures were attended by interested and friendly audiences whose command of English was impressive. (Before the war, of course, German was the second language in Czechoslovakia. Now, however, its use is discouraged, and one rarely has occasion to employ it.) Prague is famous as the birthplace and center of polarography. Although Prof. Heyrovsky was, unfortunately, absent at the time we were there, Dr., now Prof., Rudolf Brdička gave us much interesting information about the work of the Institute. The contact of the Prague scientists with America seemed excellent.

There are a number of other universities in Czechoslovakia, but in none of them has physics reached an advanced state. The celebrated German university in Prague was permanently closed after the liberation, and its buildings and facilities were taken over for other purposes.

Austria

From Prague we went to Vienna in a Pan American Airways plane. The city, and most of the people, had a melancholy air. The physical destruction in the city, of which we had heard such strong reports, did not make much impression on us after Warsaw, although some sections, particularly in the Russian sector, are very much damaged.

Our visit at the Institut für Radiumforschung was an extremely interesting one. Unfortunately, Prof. Stefan Meyer was not there; he has now virtually retired and spends most of his time in his home in Bad Ischl, in the American zone. Prof. Berta Karlik, acting director of the Institute, told us of the research programs being carried out and showed us some of the new results. One interesting investigation is the study of some nuclear reactions using, again, the new Ilford plates. (These plates are very popular on the continent today because they make possible interesting and original researches within the small budgets available.) We also learned from Prof. Karlik that a new edition of Meyer and Schweidler's *Radioaktivität* is being planned as a cooperative enterprise of a number of scientists. Unfortunately, Prof. von Schweidler died early this year. The library at the Institute is in rather good condition. Its wartime and postwar copies of American periodicals were private gifts from friends in America.

I also had the pleasure of a conversation with Prof. Karl Przibram at the Zweite Physikalische Institut. Prof. Przibram, who spent the war years in England, is again engaged in his studies of luminescence.

It was most interesting to see the new books being published by Springer in Vienna. The program of this branch of the Springer Verlag, now nominally independent of the two German branches, is impressively vigorous, and its publications to date are a remarkable achievement.

I spent a considerable part of our time in Vienna investigating the scientific and technical books published in Germany and Austria during the war. Not a few of these are very rare in America, and many are of major importance (for example, the series of volumes containing Sommerfeld's lectures on theoretical physics). The acquaintance with such books of most American scientists, the majority of whom do not have personal connections abroad, is necessarily based on those volumes republished under license by the Alien Property Custodian and selected according to the discretion, not to say the whim, of the several American firms engaged in such undertakings. It would be good to have some responsible organization in America or Britain compile and publish a complete list of wartime German and Austrian technical books. It is difficult to buy such books in Austria or in western Germany. Interestingly enough, there seem to be more for sale in the second-hand bookshops in Poland. Most of the books there are brought in from Germany.

Italy

At the invitation of Prof. Gilberto Bernardini, I spent two months working in Rome. Scientific research in Italy today is beset with difficulty, and the quantity and high quality of much of the output is a tribute to the energy and ingenuity of the workers. The funds made available by the government for salaries, libraries, and equipment are utterly inadequate; one finds this policy of the government, which directly controls the universities, deplorable. The fact that

Italian research in nuclear physics and cosmic rays still manages to stay in the very first ranks is thus all the more remarkable. The now almost historic experiment of Conversi, Pancini, and Piccioni must give great satisfaction to scientists, in America no less than in Europe, who are concerned at the connotation for the future of science of the disproportionate strength of physics in America, caused chiefly by the greatly augmented funds available in America and the trying conditions and relatively small budgets under which most Europeans are now obliged to work. Many of the most talented young men in Italy have emigrated, and a stay in Italy makes this easily understandable. The physics library in Rome is pitifully incomplete. No English periodicals are received, and the only copy of the *Physical Review* is Prof. Amaldi's private one.

The Institute for Physics, located in the 10-year-old Città Universitaria, is a great and impressive building. The floor space available is more extensive than that owned by most American physics departments, and there is some fine equipment, including a million-volt Cockroft and Walton accelerator. Prof. Amaldi, director of the Institute, told me, however, that because of the difficulty in competing with American piles and other costly equipment he is shifting the emphasis of his work from nuclear physics to cosmic rays—a sad development at the birthplace of neutron physics. However, a great deal of cosmic-ray research is in progress. In January the new Cervinia high-altitude laboratory was officially inaugurated on Monte Rosa (11,500 feet), in northern Piedmont.[2] This laboratory is under the direction of Prof. Bernardini, who spends much of his time there. In Rome the entire staff is under a great strain because of the teaching load, for, just as in the rest of Europe, the number of students has risen greatly while the number of instructors has decreased.

The chair of theoretical physics in Rome has been vacant since the departure of Wick. Although the occasional visits of foreigners (Pauli spent some weeks there in 1947, and it is hoped that Heisenberg may come for some months) and the necessarily short visits of Prof. Bruno Ferretti, who has now returned to his post in Milan after two years of work in England, have helped to fill this gap, the experimentalists are nevertheless considerably handicapped.

[2] For a description of this fine new laboratory see *Nature, Lond.*, 1948, **161**, 254, or *Physics Today*, 1948, **1**, No. 2, 14.

The physics departments of other Italian universities have not so fully recovered from the war, and now, more than ever, the most important work stems from Rome.

Conclusion

We did not have time to visit other central European countries and so can offer no firsthand information about them. Nothing is generally known in the west about the physics in Roumania and Yugoslavia, in both of which important work was accomplished before the war. In Hungary there are now several active physicists. We did visit Spain, but there is no physics there of any importance.

The question of Russian physics is, of course, of as great interest in other European nations as it is in America. However, no more is generally known. I know of only one instance of a visit by a Russian physicist to a laboratory in western Europe after the war, and even visits to eastern countries have been few, if any. Nor have I heard of any private correspondence on scientific problems between physicists in Russia and another country. All information on research, everywhere we have been, is based only on the Russian journals and on the highly glamorized and not always understandable Russian news-service releases. Even the journals are not received regularly in most places, although this is generally believed to arise from inefficient distribution.

In conclusion I should like to emphasize how important it is that American scientists more actively cultivate personal contacts with their European colleagues, by correspondence and especially by actual visits. Travel was never easier mechanically than it is today; yet for most European scientists other serious barriers to foreign visits now exist—for instance, the shortage of teachers, which prevents extended trips abroad, and the very real difficulty in obtaining foreign money. The advantages which Americans enjoy in these respects should and must be fully exploited for the mutual benefit of America and Europe. If a world community of scientists is to be achieved—and where may it more readily be than in science, for which there truly exists a world community of interest?—personal friendship and understanding can greatly aid in overcoming the barrier of disparate nonscientific ideas.

Obituary

Theodore Dru Alison Cockerell

1866–1948

"The scientific man is always on the road, never at the journey's end." Thus wrote Prof. Cockerell, of the University of Colorado, some 12 years before his death on January 26, 1948, at the age of 81, in San Diego, California. His career was the exemplification of this assertion. Decade after decade with tireless devotion he followed the path of knowledge, often blazing a new trail, constantly alert to the things of interest in the landscape about him, eager to become acquainted with the infinte diversity of life, and zealous to make others equally cognizant of it. Yet always there was a horizon beyond, something that awaited completion.

Up to the last and undeterred by illness, he gave his failing strength to the task of monographing the bees of Honduras. It was fitting that this should be his last scientific endeavor, for from his middle twenties onward bees interested him perhaps more than any other form of life. The constancy of this interest is best evidenced by the fact that up to 1938 he had published 5,480 new names for species, subspecies, and varieties, and 146 names for genera and subgenera. Since 1938 there have been accretions to this total. The description of bees believed to be new was only part of his work. Extension of the geographic range of species already known was another substantial contribution. Through one channel of publication alone—*Annals and Magazine of Natural History*—he issued about 200 successive papers devoted to descriptions and records of bees. One student of the bees, Prof. H. Friese, has hazarded the opinion that the total number of species the world over, both described and undescribed, might approximate 20,000. On the basis of this estimate, which is probably not excessive, one can visualize the magnitude of the individual contribution of Prof. Cockerell in making known the diversity and structural significance of the tiny creatures that either he himself collected or that were sent to him as a gifted specialist.

In the field of entomology there were, however, other rivals that from time to time claimed his attention. At the beginning of his career, during the few years (1891–93) that he served as curator of the Public Museum at Kingston, Jamaica, he selected the Coccidae for special attention and was able to record from Jamaica alone more species than had previously been reported from all the West Indies. His transfer subsequently to New Mexico, where he served successively in the New Mexico Agricultural College and in the Normal University, opened up new opportunities for the study of these insects, as it did for the study of the bees. Over the years his active intellect turned to other groups as well, both fossil and recent, and he produced papers dealing with the members of many orders as evidence of his broad interest in the whole field of entomology.

The number of his entomological papers is breathtaking. Those recorded in the *Zoological Record* from 1888 to 1945 number 1,240, including a few that were written in collaboration with others. In each of at least 15 of those years he published from 30 to 50 papers, and in only one of the years between 1893 and 1937, when he was well beyond the retirement age of most people, did he permit his entomological publications to descend to as low as 10. But what amazes one as much as the output is the diversity of the subject matter. Now and then there might be a dominant trend in the work of a given year. In 1919, for instance, the Philippine bees were evidently the special beneficiaries of his studies, and in 1933 he devoted 18 of a total of 27 papers to African bees. In general, however, he evidenced the range of his interest and his mental elasticity by swiftly turning from fossil to recent, from a given order to an unrelated order, from field experience or description of species to reflective discussion of biologic problems.

While insects claimed the largest measure of his attention and represented the greatest aggregate of publication, his interest in conchology tended to run in competition with that in entomology. His interest in the snails and the slugs was firmly founded early in his childhood, was reinforced when his family moved, after the premature death of his father, to Margate by the sea, and in a few years reached such a point of development that by the middle '80s, when he was still under 20 (he was born August 22, 1866, at Norwood, England), he was already contributing papers on the Mollusca to scientific publications. In 1886 no less than 17 such papers appeared. Although this maximum was never again attained and the period from at least 1893 onward was to witness a quite conspicuous disproportion in favor of entomological papers over conchological, nevertheless, in the 60 years from 1885 to 1944, there were only 11 in which he failed to contribute at least something on the Mollusca. The aggregate of his publications devoted to these invertebrates exceeds 200 papers.

It was the contention of Prof. Cockerell that he was merely an amateur botanist, that his professional work was zoological. However, the many evidences of his zeal for botany and the range of his interest in this field leave little doubt that it continued to hold an important place in his interests, even though he was able to do research in it only from time to time. Among his botanical contributions were a number of descriptions of new plants from New Mexico, a revision of the genus *Hymenoxys*, studies of the wild roses, including fossil forms discovered at Florissant, paleobotanical studies involving other plants, and his floricultural achievement in developing the red sunflower—now widely known over the globe—from a single wild plant discovered by Mrs. Cockerell.

Yet in spite of his preoccupation with entomology, conchology, and botany, not to mention other responsibilities, he still found time for research in additional fields. His studies of fish scales as an aid in the classification of the fishes won the attention of ichthyologists, and he concerned himself with other problems that lay beyond the scope of his principal interests. In 1904 he became a reviewer for the Chicago "Dial" and for a number of years discussed books over a wide range of topics.

It is impossible to write about Prof. Cockerell without emphasizing the part of Mrs. Cockerell in making his work a success. For nearly 50 years she shared his aspirations and was the intimate partner of his undertakings. She accompanied him on his field trips, whether these were made to nearby fossil localities like Florissant and Green River, or to distant parts of the world. She also took part in his scientific research, and several papers were the product of their joint authorship. On the lecture platform, too, they often appeared together to champion an issue or elucidate a problem in which they were jointly interested.

As one looks back over the career of Prof. Cockerell and tries to evaluate the qualities that enabled him to achieve so greatly, one must pay tribute, I think, not only to his keen mind, but in equal degree to his enterprise and devotion. He kept faith throughout the years with the subjects that interested him, turning his back on the smaller things that sidetrack the efforts of so many individuals and dedicating himself wholly to the attainment of goals worth while. But in this exclusiveness of effort he was never the closeted recluse. He had an inexhaustible interest not only in the depth and breadth of nature, but in his fellow man, exemplified in his cordial relations with his students, in correspondence with a host of co-workers and friends, and in cooperative acts without number.

HERBERT F. SCHWARZ
The American Museum of Natural History

NEWS and Notes

James B. Fisk has resigned his position as director of the Division of Research, U. S. Atomic Energy Commission, to become professor of applied physics at Harvard University. Dr. Fisk had been on leave from Harvard since his appointment with the AEC in January 1947.

Robert L. Pendleton, of the Office of Foreign Agriculture Relations, USDA, and the Department of Geography, Johns Hopkins University, has been appointed a special fellow to study tropical soils and land use practices in the Belgian Congo by the Belgian American Educational Foundation. Dr. Pendleton sailed August 31 for the four months of field work in the Congo. During this time his address will be c/o U. S. Consul General, Leopoldvile, Belgian Congo.

Edwin J. Hart, formerly a research chemist with the U. S. Rubber Company, recently joined the Chemistry Division of the Argonne National Laboratory as a senior chemist.

C. A. Knight recently accepted an appointment as associate professor in the Virus Laboratory, Department of Biochemistry, University of California. Dr. Knight will continue his research on the chemistry of viruses in which he was engaged while an associate of the Rockefeller Institute for Medical Research.

Freddy Homburger, former head of the Department of Clinical Investigation, Sloan-Kettering Institute for Cancer Research, has been named research professor of medicine and head of the cancer research and control units at Tufts College Medical School. **William H. Fishman,** another new appointee at Tufts, will serve as research professor of biochemistry and associate director and chief biochemist in the cancer units. Dr. Fishman formerly served on the staff of the University of Chicago.

Elmer D. West and **Geraldine Spaulding** have joined the staff of the American Institute for Research, Pittsburgh, Pennsylvania. Dr. West was formerly associate professor of psychology at the University of New Hampshire, while Miss Spaulding served as editor, National Teachers Examination Project, Educational Testing Service.

Robert Howland Denison, assistant curator at Dartmouth College Museum, was recently appointed curator of fossil fishes in the Department of Geology, Chicago Natural History Museum. Dr. Denison spent the year 1947–48 as a member of the University of California African Expedition.

Nathaniel C. Fick has been named deputy executive director of the Committee on Basic Physical Sciences, Research and Development Board. Mr. Fick was formerly associated with the Battelle Memorial Institute as a metallurgist.

L. H. Tejada-Flores, currently lecturing on electrical engineering at the

University of Southern California, has been named for postdoctorate research work under a John Simon Guggenheim Memorial Foundation Latin-American fellowship. Dr. Tejada-Flores' work on dielectric recovery will be carried on under Gilbert D. McCann and Royal W. Sorensen, of the CalTech Electrical Engineering Department.

Ivan N. Mensh, formerly a USPHS Clinical Fellow at Northwestern University, has joined the staff of the Department of Neuropsychiatry, Washington University School of Medicine, St. Louis.

F. William Sunderman, formerly professor of clinical pathology and director of the Laboratory of Clinical Medicine, Temple University Medical School, has been appointed head of the Department of Clinical Pathology at the Cleveland Clinic Foundation.

Frans Verdoorn, managing editor of *Chronica Botanica,* has been elected a Corresponding Member of the International Academy for the History of Science in Paris, and chairman of the newly-established International Phytohistorical Committee of the International Union of Biological Sciences.

Harold Vagtborg recently resigned the position of president and director, Midwest Research Institute, Kansas City, Missouri, to accept a corresponding position with the Southwest Research Institute of Houston, Texas. Dr. Vagtborg is also serving as director of the Institute of Inventive Research and the Foundation of Applied Research, as well as technical director of the Essar Ranch. **George E. Ziegler,** executive scientist of Midwest Research Institute, is assuming the administrative responsibilities of that organization until Dr. Vagtborg's successor is named.

Elizabeth E. Powelson, of Middletown, New York, has been named instructor in the Department of Biology, Hood College, Frederick, Maryland.

Robert C. Lommasson and **John F. Davidson** recently joined the staff of the Department of Botany, University of Nebraska. Dr. Lommasson, former instructor of botany at the University of Iowa, has been appointed assistant professor, and Dr. Davidson, former instructor at the University of California, has been appointed assistant professor and curator of the University herbarium.

Raj Chandra Bose, former head of the graduate Department of Statistics, University of Calcutta, will become professor of mathematical statistics at the University of North Carolina beginning in the winter of 1949. Prof. Bose had recently served as visiting professor in the Institute of Statistics at North Carolina.

S. B. Shiveley, formerly professor of botany at the state teachers college at Superior, Wisconsin, has been appointed head of the Department of Biology at Nebraska Wesleyan University, Lincoln.

Edward H. Glass, formerly entomologist with the Virginia Polytechnic Institute and the Virginia Agricultural Experiment Station, was recently appointed associate professor of entomology at the New York State Agricultural Experiment Station, Geneva. In his new work, Dr. Glass will deal primarily with insect pests of fruit trees.

Grants and Awards

Research in soils and plant nutrition will be undertaken by the Department of Agronomy, Utah State Agricultural College, under an annual grant of $1,200 recently established by the U. S. Smelting, Mining and Refining Company. The research will particularly emphasize zinc, manganese, and iron deficiencies which are important in the Great Basin area.

J. B. Peterson, head of the Agronomy Department, Purdue University, and **W. M. Myers,** of the Regional Pasture Laboratory at Pennsylvania State College, were named first winners of the two $500 Stevenson Awards for outstanding agronomy research, at the recent meeting of the American Society of Agronomy. Dr. Peterson, formerly on the agronomy staff at Iowa State, received the award for outstanding research work in soils, and Dr. Myers, for his work in crops research. The Stevenson Awards, the purpose of which is to encourage agronomic research, particularly among younger members of the Society, were made possible through a gift of W. H. Stevenson, of the Iowa Agricultural Experiment Station, and his wife.

Gerty T. Cori, professor of biochemistry in the Washington University School of Medicine, was the recent recipient of the Francis P. Garvan Medal honoring women in chemistry. Dr. Cori, sole woman Nobel Prize winner, received the gold medal during the recent Eastern Session of the 114th national meeting of the American Chemical Society held in Washington, D. C. Dr. Cori was cited for her varied and extensive research in biochemistry, particularly on carbohydrate metabolism and enzymatic reactions.

Harry Goldblatt, director of the Institute for Medical Research of Cedars of Lebanon Hospital, Los Angeles, California, is the 1948 recipient of the Charles Mickle Fellowship of the University of Toronto. This award is made to the member of the medical profession who is considered by the council of the faculty of medicine of the University to have done the most during the preceding 10 years in advancing sound knowledge of a practical kind in medical art or science. Dr. Goldblatt was honored for his research on the relationship of the kidney to arterial hypertension.

The American Pharmaceutical Association, at its recent annual convention in San Francisco, awarded the Kilmer Prize to Charles R. Chase, Jr., of Stockton, California, and the 1948 Ebert Prize to Harry W. Hind, of the Barnes-Hind Laboratories, San Francisco.

Mr. Chase, a recent graduate of the University of California College of Pharmacy, received the Kilmer Prize, an inscribed gold key, for his system of identifying botanical drugs by their fluorescent glow when exposed to invisible, near-ultraviolet rays. As recipient of the Ebert Prize Medal, Mr. Hind, a practicing pharmacist and coowner of the Barnes-Hind Laboratories, was cited for his skillful research on methods for preparing drug solutions for use in the eye. In this work, Mr. Hind was aided by Frank

M. Goyan, assistant professor of chemistry at the College of Pharmacy, University of California. Dr. Goyan received an honorable mention for his contribution to the investigations.

W. T. Salter, professor of pharmacology, Yale University School of Medicine, was selected to receive the first $1,000 Iodine Educational Bureau award. This award will be presented to Dr. Salter at the next annual meeting of the Association, when he will present a review paper on his investigations. Dr. Salter was recognized for his "long and continued basic research relating either directly or indirectly to iodine, and his impressive contributions of more than 30 publications on this general subject during the past 10 years."

Colleges and Universities

The University of California at Los Angeles has announced that preliminary studies are under way for a new Chemistry and Geology Building. The new structure, consisting of about 150,000 square feet, will include geological and chemical laboratories and libraries, together with 5 large lecture rooms. On completion of the new building, UCLA's present Chemistry Building will be remodeled as a Social Sciences Building. An appropriation of over $5,000,000 has been made to cover erection of the new building and conversion of the present Chemistry Building.

The Department of Zoology, State College of Washington, through its chairman, Herbert L. Eastlick, has announced a group of staff additions which have just become effective. In the subdivision on wildlife management, Irven O. Buss, former chief of wildlife research, Wisconsin Department of Game, has been appointed professor, and Helmut K. Buechner, until recently working on his Ph.D. at Oklahoma A & M College, has been named instructor.

In the subdivision on zoophysiology, Morris Rockstein, NRC Fellow at the University of Minnesota, has been appointed professor, and Verner L. Johnson, formerly assistant professor at Pacific Lutheran College, will assume the duties of instructor and continue work on his doctorate.

Robert Whittaker, who recently completed his Ph.D. requirements at the University of Illinois, has been appointed instructor in zoology and will also develop courses in ecology.

The Department of Physiology, New York State Veterinary College, Cornell University, presented a series of lecture-demonstrations in physiology for teachers of physiology or pharmacology during the week of July 5–10. Thirty-six persons representing 27 U. S. and Canadian colleges and universities attended the sessions, which included many demonstrations on the blood, heart and circulation, urine secretion, respiration, alimentary tract, nervous system, and muscular activity.

The Gamma Chapter of Alpha Epsilon Delta, national premedical honor society, has been installed at the University of Miami as the 47th chapter of that society. H. E. Setterfield, of the School of Medicine, Ohio State University, national president of the society, and Emmett B. Carmichael, of the Department of Biochemistry, Medical College of Alabama, national councilor of Alpha Epsilon Delta, conducted the initiation of the charter members with the assistance of W. H. Steinbach, former national president of the society and head of the Department of Chemistry at Miami, who is faculty adviser for the Florida chapter. Honorary members initiated at the installation were E. Morton Miller and Julian D. Corrington, of the Department of Zoology, and Harry P. Schultz, of the Department of Chemistry.

Alpha Epsilon Delta, an affiliated society of the AAAS and a member of the Association of College Honor Societies, was established April 28, 1926, at the University of Alabama. Its objective is to encourage excellence in premedical scholarship, to stimulate an appreciation of the importance of premedical education in the study of medicine, to promote cooperation and contact between medical and premedical students and educators in developing an adequate program of premedical education, and to bind together similarly interested students. In the 22 years since its founding, its total membership has increased to over 7,200 members and its 47 chapters have spread throughout the United States.

The Indiana University Medical Center, Indianapolis, recently announced that two major construction projects had been approved for the Center. One is the expansion of the Department of Radiology; the other, erection of a research wing to the James Whitcomb Riley Hospital for Children. The former will add 5,600 square feet of floor space to the Department, provision being made to employ the latest safeguards for use of radioactive materials and X-rays. The latter, for which the state has allocated several hundred thousand dollars, will provide laboratories for research on children's diseases. A grant of $250,000 has been approved by the Riley Memorial Association in support of this research over a 5-year period.

A Mechanics Colloquium has been planned by Illinois Institute of Technology to include a series of 8 monthly meetings for the coming academic year. Prominent eastern and midwestern scientists will speak before the Colloquium meetings, which are open to the public. All meetings, except that scheduled for October 6, will be held on the Illinois Tech Campus, 3300 South Federal Street, Chicago. Lectures, scheduled for 8:00 P.M., will be preceded by a dinner at 6:30 P.M.

The Colloquium schedule is as follows: October 6, "Interpretation of Service Fractures," R. E. Peterson, manager, Mechanics Division, Westinghouse Research Laboratories (lecture to be held in Technological Institute, Northwestern University, Evanston); November 3, "Latest Developments in Jet Propulsion," J. T. Rettaliata, dean of the Division of Engineering, Illinois Tech; December 1, "An Applied Mathematician's View of the Problem of Elastic Stability," J. J. Stoker, professor of mathematics, Institute for Mathematics and Mechanics, New York University; January 5, "Evaluation of Brittle Coating as a Tool for Experimental Stress Analysis," A. J. Durelli, research engineer in mechanics, Armour Research Foundation; February 2, "Some Phenomena of Nonsteady Flow," W.

Spannhake, research scientist, Hydrodynamics Section, David Taylor Model Basin, Washington, D. C.; March 2, "Bridges and Aerodynamics," D. B. Steinman, consulting engineer, Robinson and Steinman, New York City; April 6, "Aircraft Flutter Problems," N. C. Myklestad, professor of theoretical and applied mechanics, University of Illinois; and May 4, "Stress, Strain Rate, and Strain Relations in the Plastic Range, Including an Analysis of Finite Homogeneous Strains," A. Nadai, consulting engineer, Westinghouse Research Laboratories.

Individuals desiring regular announcements of the Colloquium meetings are requested to notify R. L. Janes, Illinois Institute of Technology, Technology Center, Chicago 16, Illinois.

Industrial Laboratories

The world's largest X-ray development laboratory was dedicated September 13 by the General Electric X-Ray Corporation, Milwaukee, Wisconsin, as a permanent living tribute to William D. Coolidge, X-ray pioneer and director emeritus of the G-E Research Laboratory, Schenectady, New York. Known as "the father of the modern X-ray tube," Dr. Coolidge has been honored by 13 medals and 7 honorary degrees from scientific and educational organizations.

The new G-E laboratory, representing an expansion program begun over two years ago, includes the William D. Coolidge Laboratory together with expanded facilities formerly located in Chicago. The new units will provide for volume output and extensive experimental work for new X-ray applications in medicine and industry.

Speakers at the dedication ceremonies, held on the laboratory grounds, included, in addition to Dr. Coolidge, Arthur C. Christie, professor of clinical radiology at Georgetown University Medical School and chairman of the Committee on Radiology, NRC, Charles E. Wilson, president of the General Electric Company, and others.

The Westinghouse Research Laboratories have recently appointed Richard C. Hitchcock as science lecturer for the Laboratories. As his first assignment, Dr. Hitchcock is directing the Westinghouse "Theater of Atoms," an atomic energy show prepared for New York City's anniversary celebration. Later, Dr. Hitchcock, who has spent over 30 years in research and lecture work, will tour the country with special, popular shows of current scientific achievements.

Meetings and Elections

A Symposium on Polymer Chemistry in England, sponsored by the Institute of Polymer Research, Polytechnic Institute of Brooklyn, will be held in the Institute's Student Lounge, 99 Livingston Street, Brooklyn, on September 25, under the chairmanship of P. J. Flory, of Cornell University. Participants include E. K. Rideal, of the Royal Institution, London, whose topic will be "Surface Chemistry of Macromolecules"; R. G. W. Norrish, of the University of Cambridge, who will speak on "Low-Temperature Polymerization"; and G. B. B. M. Sutherland, also of the University of Cambridge, who will discuss "Infrared Investigation of Macromolecules."

A symposium on "Fundamental Properties of Protoplasm" will be held October 4–6 under the sponsorship of the Detroit Institute of Cancer Research. The symposium, marking the official opening and dedication of the Institute, will also provide its first annual scientific program. The first two days of the program will be devoted to the fundamental sciences, and the speakers will include: C. A. Baumann, "Dietary Aspects of the Tumor Problem"; G. W. Beadle, "Genes and the Function of Protoplasm"; Robley D. Evans, "Quantitative Aspects of Radiation Carcinogenesis in Humans"; W. O. Fenn, "Evidence for the Conversion of CO to CO_2 by Living Tissues"; Harry S. N. Greene, "The Biological Assessment of Tissue Potentialities"; Max A. Lauffer, "Hydrations of Viruses and Proteins"; Karl Meyer, "Mucopolysaccharides and Mucolytic Enzymes"; John L. Oncley, "Human Plasma Lipoproteins"; and T. M. Sonneborn, "Cellular Transformations and Their Physical Basis." Detlev W. Bronk and Carl F. Cori will also speak on topics to be announced later.

Speakers on clinical topics scheduled for the October 6 session include: Charles Cameron, "Cancer Education for the General Practitioner"; Bradley L. Coley, "Advances in Diagnosis and Treatment of Tumors of Bone"; Murray M. Copeland, "Benign Tumors of the Female Breast"; Stuart W. Harrington, "Cancer of the Breast"; and Thomas E. Jones, "Cancer of the Rectum and Rectosigmoid."

Scientists interested in fundamental research and its relation to the problem of malignant growth are cordially invited to attend the symposium. Further information may be obtained by writing William L. Simpson, Scientific Director, Detroit Institute of Cancer Research, 4811 John R Street, Detroit 1, Michigan.

The Society for Applied Spectroscopy recently announced its current schedule of meetings to be held the first Tuesday of each month. Speakers and lecture titles for the forthcoming 5 meetings are as follows: October 5, Van Zandt Williams, "Developments in Infrared Absorption Spectrometry"; November 9, Lester W. Strock, title to be announced later; December 7, Wallace A. Brode, "Ultraviolet Absorption Spectroscopy"; January 4, speaker to be announced later; February 1, F. Nolan, "Fluorescence in the Field of Spectroscopy." Meetings will be held at the Lecture Hall, Old World Building, 63 Park Row, New York City, at 8:00 P.M.

E. K. Jaycox, of the Bell Telephone Laboratories, Murray Hill, New Jersey, is serving as chairman of the Society, and R. R. Hampton, of the U. S. Rubber Company, Passaic, New Jersey, is acting as secretary.

At the 67th annual meeting of the American Forestry Association, to take place at Chattanooga, Tennessee, October 8–11, keynote speeches will be made by Representative Clifford R. Hope, of Kansas, and Gordon Clapp, chairman of the Tennessee Valley Authority. According to W. S. Rosecrans, president of the Association, the meeting will feature studies of cooperative land management by Federal, State, and private enterprise and will include a series of field trips to

TVA projects and examples of private forestry in the Tennessee Valley.

Reservations for the meeting may be made through the office of the Association, 919 17th Street, N. W., Washington, D. C.

The Optical Society of America is holding its 33rd annual meeting at Hotel Fort Shelby, Detroit, Michigan, October 21–23. As usual, the meeting will be open to nonmembers of the Society, and all interested persons are invited to attend. The foremost manufacturers of optical instruments will exhibit their products during the meeting. An interesting and varied program has been planned, with leading authorities in the field of optics participating.

A group of Arkansas physicians interested in the activities of the American Heart Association organized an Arkansas Heart Association on July 16 of this year and elected the following officers: president, Joseph T. Roberts, dean of the University of Arkansas School of Medicine; vice-president, Driver Rowland, of Hot Springs Arkansas; secretary-treasurer, John E. Greutter, of Little Rock, Arkansas. This organization will operate in accord with the principles of the American Heart Association.

Officers of the Institute of Navigation for the academic year 1948–49 have been announced as follows: president, Rear Adm. G. G. McLintock, USMS, superintendent of the U. S. Merchant Marine Academy, Kings Point, Long Island; technical adviser to president, Paul Rosenberg, president of Paul Rosenberg Associates, New York City; executive secretary, Samuel Herrick, chairman of the Department of Astronomy, University of California, Los Angeles; treasurer, Keith F. Smith, of Los Angeles. A number of vice-presidents, regional vice-presidents, and chairmen of the Institute's National Committees were also elected.

The Institute is a nonprofit scientific and engineering society devoted to the advancement of navigation and related sciences and, as such, sponsors the coordination of study and research in navigational problems in universities, military services, government agencies, and industrial laboratories throughout the United States.

During the International Powder Metallurgy Conference, held at Graz, Austria, July 12–17, the Technische Hochshule of Graz conferred the honorary degree of Doctor of Technical Sciences on W. D. Jones (London), Paul Schwarzkopf (Yonkers, New York), J. A. Hedvall (Göteborg, Sweden), A. F. Joffe (Moscow), and L. Neel (Grenoble, France).

Deaths

William E. Burge, 66, who was associated with the Department of Physiology at the University of Illinois for many years, died March 28 at his home in Indian River City, Florida. One of Dr. Burge's important fields of research was in catalase and metabolism of various tissues.

Benjamin F. Lutman, 68, emeritus professor of plant pathology at the University of Vermont and State Agricultural College, and plant pathologist of the Vermont Agricultural Experiment Station, died July 20 following a heart attack.

Lloyd William Taylor, 55, professor and head of the Department of Physics, Oberlin College, since 1924, was killed in a fall on Mt. St. Helens, Washington, August 8. Dr. Taylor had also served as a former associate editor of *Review of Scientific Instruments, Journal of the Optical Society of America,* and *American Physics Teacher.*

Robert M. Grey, 87, superintendent emeritus of the Atkins Garden and Research Laboratory, Harvard University, died August 13 following a long illness in Central Soledad, Cienfuegos, Cuba.

Scott B. Lilly, 63, chairman of the Division of Engineering, Swarthmore College, died August 19 in Philadelphia, Pennsylvania.

Samuel Chiles Mitchell, 83, former president of the University of South Carolina, the Medical College of Virginia, and Delaware College, now the University of Delaware, and more recently, professor of history and government at the University of Richmond, died August 20 in Atlanta, Georgia.

Samuel W. J. Smith, 77, professor emeritus of physics and former dean of the faculty of science at the University of Birmingham, died August 20 in London, England.

Clell Lee Metcalf, 60, head of the Department of Entomology at the University of Illinois, died August 21 in Urbana. Dr. Metcalf had been on leave of absence for 2 years because of ill health.

Joseph C. Pfister, 81, former professor of mathematics and astronomy at Columbia University, died August 22 in the Presbyterian Hospital, Newark, New Jersey. In 1945 Dr. Pfister endowed the Pfister Fellowship Fund at Columbia.

Davis W. Beaumont, 31, assistant professor of chemistry at Indiana University, died August 25 at the University Medical Center, Indianapolis, of polioencephalitis.

William Ferdinand Meyer, 67, professor of astronomy at the University of California, died August 30 in Berkeley, California.

Louis Berger, 52, professor of pathology and director and co-founder of the anticancer center at Laval University, died in Quebec, Canada, August 31.

Sylvanus G. Morley, 65, internationally known archaeologist and author, and specialist in Maya hieroglyphic writing, died in Santa Fe, New Mexico, on September 2. Dr. Morley, director of the School of American Research and the Museum of New Mexico, had formerly served as an associate in the Division of Historical Research, Carnegie Institution of Washington, and directed its Chichen Itza project from 1924 to 1940.

Abraham Myerson, 66, noted neurologist, psychiatrist, and author, died in Boston September 3. Professor of clinical psychiatry, Harvard Medical School, and director of research at Boston State Hospital, Dr. Myerson was also on the staff of Tufts Medical School as professor emeritus of neurology.

Richard C. Tolman, 67, noted mathematical physicist and wartime adviser on the Manhattan Project, died September 5 at the Huntington Memorial Hospital, Pasadena, California. Dr. Tolman, dean of the Graduate School at the California Institute of Technology, had served as professor of physical chemistry and mathematical physics at CalTech for the past 27 years. Dr. Tolman was vice-chairman of NDRC, and following the war was scientific adviser to Bernard Baruch on the UN Atomic Energy Commission.

The Hayden Planetarium is presenting during September a vivid demonstration entitled "The 200-Inch Telescope" by which visitors may seemingly enjoy a night within the world's largest astronomical observatory itself. In this unusual setting, the lecturer will review the evolution of telescopes with a discussion to follow on the comparative possibilities of Palomar Observatory's 200-inch Hale reflector and Mount Wilson's 100-inch reflector, the next largest of its kind.

A large new institute for general scientific research which will be open to the scientists of the world is to be created in the Belgian Congo, according to a preliminary report released September 1 through Harlow Shapley, director of the Harvard College Observatory. The international character of the new institute, which will have an initial endowment of $9,000,000 and an additional annual subsidy of more than $500,000, is emphasized through the recent appointment of Dr. Shapley, E. B. Worthington, English biologist, and A. Chevalier, French botanist, to the Board of Administrators by the Belgian Government. The director of the new scientific foundation, which will naturally specialize on problems of the tropics, is Louis van den Berghe, professor at the Institute of Tropical Medicine in Antwerp and visiting professor of tropical medicine at Tulane University.

The purpose of IRSAC (Institute pour la Recherche Scientifique en Afrique Centrale), according to the statement submitted by Dr. van den Berghe, is the fundamental study of the tropical environment, human, zoological, and botanical. Several research stations will be erected in the next two years, the main one, most probably, on the high plateau region between Lake Kivu and Lake Tanganyika. A second station will be erected before the end of the current year in the Province of the Equator, not far from the mouth of the Congo, and a third in southeastern Katanga. Also, two stations, one in the east and another in the west, are planned for seismologic and ionospheric measurements.

Field work has been started, or will develop soon, on the lines of social and physical anthropology, climatology, nutrition, hydrobiology, geology, plant and animal ecology, and a party is in the field searching for a most suitable site for a high-altitude astronomical observatory.

IRSAC will provide fellowships and subsidies to the scientists established in the Congo. Its aim is to coordinate and inspire the various scientific institutions and services there. It will have its own scientific and technical staff and will act as an agency of information for visiting scientists to the Congo and provide them with material help and various facilities for their explorations and researches. Work tables and other facilities will be kept at the disposal of Belgian and foreign scientific institutions in the different stations of IRSAC. It is planned that the institution will assemble an important and appropriate library at its main station. American scientific institutions that are able to contribute current and past publications should address them to IRSAC, Costermansville, Belgian Congo.

Dr. van den Berghe, the director of IRSAC, is already established at Costermansville, on Lake Kivu in the high mountainous region of the eastern Congo.

The Belgian Congo offers much virgin territory for explorations by scientists and affords also a wide variety of conditions, varying from mountains that rise above the tree line to the equatorial jungles. In the high plateaus in the regions of the Great Lakes and the Kivu Mountains, Europeans can live with comfort, even though but a few degrees south of the equator. Around Lake Kivu there are extensive agriculture developments, with coffee, grain, pyrethrum, and cotton among the products.

The region is especially suited to new researches in anthropology. Among the native tribes are the pygmies and the giants that live east of Lake Kivu on the borders of Tanganyika. The Congo is also famous for its radium deposits, and it is one of the largest sources of uranium ores.

The president of the Board of Administrators of IRSAC is E. deBruyne, of the University of Ghent, who was formerly Minister of Colonies in the Belgian Government. Among the administrators are many of the most distinguished scientists and educators of Belgium, representing, among other fields, geology, biochemistry, astronomy, mining, engineering, ethnology, sociology, veterinary medicine, physics, agronomy, and paleontology.

Although no scientific journal will be maintained by IRSAC, a scientific report, with general subjects and abstracts of the papers of the members and guests of IRSAC published elsewhere, will appear annually and will be distributed widely among scientific institutions of the world.

Outstanding scientific and technological developments of the last 41 years of aviation will be displayed to the public on September 18, Air Force Day, at Bolling Air Force Base. Features of the large-scale show will include the arrival of a pilotless drone B-17 and its "mother" ship from Elgin Air Force Base in Florida; a display of guided missiles; many static exhibits which will draw attention to the work of the Air National Guard, the Materiel Command, the Air Engineer, and the Air Surgeon; and a mock bombing raid on the Base with seasoned pilots at the controls of the fast new ships.

Speediest AF fighter plane now in production is the F-86 (see cover), a North American product powered by a J-35 jet engine and featuring swept-back wings and tail surfaces. The plane has a maximum speed of 650 miles an hour and a combat range of 1,000 miles.

Comments and Communications

Starch Blue

Blue color has long been associated with the presence together of starch and iodine. This empirical fact has been without satisfactory explanation. Theories of a starch-iodide compound, a starch-iodide complex, and, more recently, a theory of adsorption have been advanced.

With the use of radioactive iodine it has been possible to show that the change leading to blue color is a change induced in the starch molecule by iodine acting catalytically in the presence of oxygen and that the blue color is not dependent on the presence of iodine.

To 2 ml of 1% corn starch solution, 2 ml of iodine solution (10 mg of KI, 4 mg of I_2) and 10 microcuries of I^{131} (radioactive iodine) were added. After allowing contact for 3 hrs, iodine was withdrawn by repeated butanol extraction. (An analytical reagent grade of butanol is necessary to prevent loss of blue color by contaminants. It has long been known that so-called "starch-iodine blue" loses its color in the presence of NaOH.) After complete extraction of the iodine, the butanol was found to contain the radioactive iodine, while no radioactivity was found in the starch blue. (If on dehydration the precipitate becomes red, the blue color is returned by washing with water.)

This finding is comprehensible when one recalls that the dye stuff, indigo, prior to its synthetic preparation, was obtained from the East Indian plant, indican, and occurs as an indoxyl-glucoside which goes onto the cloth in a colorless vat form and is then air-oxidized to the indigo color form.

The test reported above confirms earlier work in which it was possible to demonstrate the absence of iodine in starch blue by the following method:

To 50 ml of 2% starch (1 gm of corn starch to 50 ml of H_2O) 50 ml of H_2O_2 was added. To this, 5 ml of 1% KI was added. Formation of dark blue color was followed by extraction with 800 ml of butanol in 50-ml lots over a period of time. For some time the butanol extracted showed brownish and yellow coloration. When the butanol was completely white and the ppt. a blue-black, the ppt. was examined for iodine by the following method: The sample was decomposed in a Parr peroxide bomb using sodium peroxide and accelerating agents. The fusion was dissolved in dilute HNO_3, and the halogens precipitated as silver salts which were filtered out on an asbestos Gooch crucible. From here analysis was by Scott's Standard Method of Analysis (5th ed., Vol. 1, p. 276). There was no evidence of iodine by this method.

While this method had demonstrated no iodine, it is a cumbersome procedure. The method employing radioactive iodine is simple and direct and would appear to be a conclusive demonstration.

This finding is interesting in connection with the action of thyroxin (the catalytic activity of the iodine of diiodotyrosine) in carbohydrate metabolism.

We are indebted to Lorraine Kirschner, of the Massachusetts General Hospital, for the Geiger determinations.

NAOMI C. TURNER

Forsyth Dental Infirmary, Boston

Preparation of Succindialdehyde and Its Derivatives From Furan

The investigations of Clauson-Kaas and co-workers (N. Clauson-Kaas. *Kgl. danske Vidensk Selsk., Math.-Fys. Medd.*, 1947, 22, 6; *Chem. Abstr.*, 1948, 42, 1930; N. Clauson-Kaas, F. Limborg, and J. Fakstorp. *Acta Chem. Scand.*, 1948, 2, in press) have resulted in the development of a convenient method for the synthesis of 2,5-dialkoxy-2,5-dihydrofurans. Attempts to hydrogenate these compounds, using Pt or Pd catalysts, resulted in mixtures of hydrogenation and hydrogenolysis products. It has now been found that catalytic hydrogenation of one of these products over a Raney-Ni catalyst offers a simple and direct route for the preparation of succindialdehyde. Hydrogenation of 2,5-diethoxy-2,5-dihydrofuran in absolute ethanol with a catalyst prepared according to Pavlic and Adkins (*J. Amer. chem. Soc.*, 1946, 68, 1471) proceeds fairly rapidly at room temperature under a hydrogen pressure of about 50 p.s.i. to give a 79% yield of 2,5-diethoxy-tetrahydrofuran (I). This product, which is an acetal of succindialdehyde, boils at 30°–31°/1 mm and is readily converted to the *bis*-phenylhydrazone (m.p., 123°), dioxime (m.p., 169°), and *bis*-semicarbazone (m.p., 192°) of succindialdehyde. Hydrolysis of (I), following the procedure described by Harries (*Chem. Cbl.*, 1901, II, 307), gives the free aldehyde in a 30% yield.

A detailed account of the hydrogenation of 2,5-dialkoxy-dihydrofurans will be published elsewhere.

JØRGEN FAKSTORP,[1] DOLORES RALEIGH, and L. E. SCHNIEPP

Northern Regional Research Laboratory,[2] Peoria, Illinois

Sex and Vigor in *Populus*

A point of some interest to geneticists and tree breeders is suggested by the preliminary analysis of data on the sex of a number of poplar clones selected in the fall of 1947. The material assembled represents the initial collection of a project sponsored by the Maria Moors Cabot Foundation and designed to assess the degree of wild variability prevailing within various species of the genus. Out of 76 clones (including *tremuloides*, *grandidentata*, *Tacamahaca*, *trichocarpa*, and *deltoides*) bearing flower buds, only 18 (23.7%) proved to be females. Several factors were involved which would tend to destroy the true randomness of the sample. The most important of these

[1] American Scandinavian Foundation Fellow, 1947–48.

[2] One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

seems to be that the individual trees were selected on the basis of their apparent vigor, health, and good stem form as compared with their associates in the various stands throughout the United States and Canada, where the collections were made. This, then, suggests that a positive correlation may exist in this genus between maleness and such desirable characters as vigor and form.

Further support of this hypothesis is revealed by a check of the old cottonwood or black poplar clones long cultivated in Europe. G. Houtzagers (*Het Geslacht Populus in Verband met zijn Beteekenis voor de Houtwelt* (The genus *Populus* and its significance in silviculture). Wageningen, Netherlands: H. Veenman and Zonin, 1937), for instance, in his description of poplar clones cultivated in Holland, notes that of the 8 most commonly planted, only 2 (25%) are females.

If the accumulation of more extensive data confirms these preliminary observations, it is needless to point out that this knowledge will be an invaluable tool to tree breeders and silviculturists interested in the genus *Populus*.

SCOTT S. PAULEY

Harvard University,
Harvard Forest, Petersham, Massachusetts

Weed Control—A Liquid Concentrate of the Isopropyl Ester of 2,4-D Miscible With Oil or Water in Any Proportion

A number of proprietary concentrates of various esters of 2,4-D are on the market, but few, if any, of them carry more than 40–45% of the parent ester. When added to the diluting water, many of these concentrates produce a smooth white emulsion which remains in stable suspension for only a very limited time. Thus, in about an hour, two distinct layers may begin to form, the upper water-like and the lower a dense white flocculation. A casual examination of the white flocculent material would suggest that this substance consisted of a precipitate of 2,4-D acid in fine division. A consideration of the chemical reaction which occurs upon the preparation of the ester would appear to support the suggestion that 2,4-D acid was depositing at the bottom of the container by virtue of a reversal of the acid-alcohol to ester-water reaction.

An associate in this laboratory has shown that the so-called hydrolysis of the ester in the diluting water does *not* take place, except at a very slow rate. A difference in density between the ester, its coupling agent, and the diluting water accounts for the precipitate of dispersed globules of oily material settling out by gravity. Obviously, the spraying of such a dispersion in the field or glass house, without frequent agitation, introduces errors not only in the uniformity of the application of the active constituent of the herbicide, but also in the subsequent evaluation of the treatment.

An effort was made in this laboratory to develop a concentrate of 2,4-D which would carry about double the amount of 2,4-D to be found in proprietary preparations of this character. A simple process, involving dilution with water, was also recommended to plantation workers in which the precipitation of oily globules could be inhibited for a sufficient length of time to assist materially in a more even application of the spray components. With fuel oil, Diesel oil, and other petroleum oils, this concentrate forms a clear solution.

The formula follows:

Concentrate No. 1

Dissolve, in the cold, 15 lbs of conditioning agent[1] in 85 lbs of clear isopropyl ester of 2,4-D (weight approximately 10 lbs/gal). This carries 70.4% of 2,4-D (calculated to acid) or about 7 lbs of 2,4-D acid/gal.

To inhibit rapid settling of heavy oily globules in the water dispersion of Concentrate No. 1, add from 8 to 10 pints of Stoddard solvent to each gallon of concentrate before incorporating the diluting water.

Observations made in current pre-emergence field studies indicate that 1¼ pints of Concentrate No. 1, diluted to 25 gals with Diesel oil and applied evenly upon the bare soil surface over 1 acre of planted sugar-cane seedpieces, will arrest the germination and growth of weed and grass seeds and seedlings for 7 weeks. This treatment has not shown as yet any abortive effect upon the germination and growth of the planted seedpieces.

Concentrate No. 1, diluted with Diesel oil at from 2 to 4% equivalent of 2,4-D acid, shows promise of controlling the growth of woody pests such as guava, lantana, Java plum, etc. Application should be made to the basal portion of the plant, not the foliage. From 50 to 100 ml of the diluted concentrate may be used. No primary treatment of the tree or shrub is required. A slight cupping out of the soil where the plant emerges from the ground may be helpful. The effect of the treatment may show progressive action for 5 or 6 months. The conditioning agent, it is believed, renders the diluted concentrate miscible with plant moisture after the treatment permeates the bark.

Concentrate No. 1 has one outstanding disadvantage. It employs the isopropyl ester of 2,4-D, the latter exerting an appreciable vapor tension. Even when diluted to 160 times its original volume with Diesel oil, the "vapor drift" of the ester may carry to nearby sensitive vegetation.

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[1] There are several conditioning agents which may be used. Good results were obtained in Hawaii in which we employed an oleate of polyoxyethylene hexahydric alcohol (Atlas G-1096).

TECHNICAL PAPERS

The Path of Carbon in Photosynthesis: II. Amino Acids[1]

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The amino acid constituents of the green algae *Chlorella pyrenoidosa* and *Scenedesmus* D-3 have been examined after exposure to $C^{14}O_2$, using the method of paper chromatography. Not only have the free amino acids been identified, but the radioactive members of the group have been ascertained.

The methods used in these experiments, which have been previously described (*2, 3*), involve the preparation of filter paper chromatograms of whole-cell extracts (80% ethanol) or of amino acid mixtures obtained by absorption on cation exchange resins from the plant extracts (*1*). The paper chromatograms of the radioactive amino acids were either scanned with a Geiger counter or radioautographed.

In *Scenedesmus* we have found the following amino acids, listed in the order of decreasing relative intensity of ninhydrin color on the chromatogram: glutamic acid, "unknown,"[2] alanine, serine, arginine, valine, aspartic acid, leucines, phenylalanine, tyrosine, α-aminobutyric acid (†), lysine, β-alanine, threonine, glycine, and proline.[3] The radioactive amino acids photosynthesized by *Scenedesmus* from $C^{14}O_2$ in 30 sec (*1*) include predominantly aspartic acid[4] with somewhat less alanine. Other radioactive amino acids synthesized under these conditions and detected by radioautography included asparagine, serine, β-alanine, and phenylalanine.

When the radioactive amino acids synthesized in the dark (1 min) by preilluminated (10 min) *Scenedesmus* were separated, the predominant radioactive product was aspartic acid with somewhat less labeled alanine. Radioactive phenylalanine is synthesized in much smaller amount.

The analysis of *Chlorella* is not yet as complete as that for *Scenedesmus*. The following amino acids have been found in *Chlorella* extracts: glutamic acid, leucines, alanine, valine, glycine, and β-alanine. *Chlorella* w have been allowed to photosynthesize with $C^{14}O_2$ fo sec form a predominant amount of radioactive asp acid with almost as much alanine. Minor radioac products include β-alanine and serine. Dark (1 m $C^{14}O_2$ fixation by preilluminated (60 min) *Chlorella* yi largely radioactive alanine.

In all paper chromatograms the glutamic acid ninhyd spot was strongly evident. In no case was any radi tivity found coincident with this spot. In cases wh glutamine was present, no corresponding radioacti was observed.

Thus, it appears that in both dark reduction of C and photosynthesis the same pattern of radioactivity the amino acids occurs. In both cases the amino a which have been identified correspond to the 3- and 4-c bon amino acids. This is in accord with the tentat scheme proposed earlier (*1*), which inferred that th carbon amino acids, alanine, serine, and β-alanine, h their origin in pyruvic acid and the 4-carbon ones h the origin of their carbon skeletons in oxalacetic a The positive determination of the absence of radioac glutamic acid is to be taken as evidence against the p ticipation of the tricarboxylic acid cycle in the anab path of CO_2 in photosynthesis.

[1] This work was performed under contract No. W-7405-Eng-48 with the Atomic Energy Commission in connection with the Radiation Laboratory, University of California, Berkeley.

[2] Identical with Spot #23 of Dent, Stepka, and Steward and very probably the same compound reported as (b) with chromatograms of *E. coli* digest (A. Polson. *Nature, Lond.*, 1948, **161**, 351).

[3] Due to the yellow color of this ninhydrin spot, it is not possible to compare its intensity.

[4] Aspartic acid may be as high as 75% according to cocrystallization assay.

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Significance of Distribution of Fluorescein in Sarcoma 180[1]

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Medical Divisi
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Moore, in a recent report (*2*) on the use of previo injected fluorescein in the diagnosis of human tu at operation, stated that under the conditions of study (dose—5 cc of 20% solution intravenously; du tion between injection and operation—3–8 hrs) fluo

[1] This work was conducted in part by a grant from American Cancer Society to the Department of Preven Medicine, The Johns Hopkins University School of Medic recommended by the Committee on Growth of the Natio Research Council. These studies form part of a joint pr ect on the chemotherapy of cancer being conducted at T Johns Hopkins University School of Medicine, Departm of Preventive Medicine, and the Medical Division, Ar Chemical Center, Maryland.

Technical assistance in this study was rendered by Art J. Fisk.

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...ence was found only in non-necrotic areas of either primary or metastatic tumors, although it also occurred in areas of edema or cyst formation. In experiments made to determine whether this report could serve as the basis for a method of determining viable areas of mouse tumors prior to transplantation, and thus of reducing the incidence of failure of take, the following results were obtained.

TABLE 1

DISTRIBUTION OF FLUORESCEIN IN SARCOMA 180 AT INTERVALS AFTER INTRAVENOUS ADMINISTRATION

Time	Fluorescence	
	Animal tissues*	Tumors†
...der 12 min	Marked	Nonuniform fluorescence, tending to be higher on periphery
12 min–3 hrs	Marked early to none at 3 hrs, with some variability	Uniform marked fluorescence
4–7 hrs	None	Marked fluorescence in necrotic areas: tended to decrease by 7 hrs

*Fluorescence was present at all times in the colon, gall-bladder, and urinary bladder—the normal routes of excretion of fluorescein (*1*).

†In a few animals with spontaneous mammary carcinoma, this tumor showed essentially the same sequence of changes in distribution of fluorescein as the transplanted sarcoma 180.

Carworth Farm mice weighing 20–25 gm and bearing 15-day-old transplants of sarcoma 180 (with some variation in size) were injected intravenously with 0.25 cc of a 1:14 dilution of saturated fluorescein in normal saline and killed at various times after injection by crushing the cervical cord. The animals were opened, the tumors hemisected, and both animals and tumors examined under ultraviolet light. Sixty-eight mice (136 tumors) were studied in groups at intervals from less than 1 min after injection up to ½ hr, and at ½-hr intervals to 7 hrs. The findings in the various groups are summarized in Table 1.

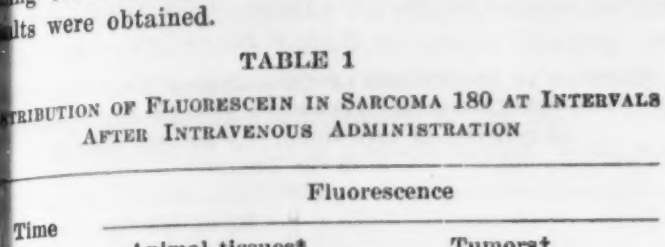

FIG. 1. (a) Section of tumor at 5 mμ; pale central area is necrotic. (b) Diagram of same tumor at autopsy; outlined central area showed fluorescence. Note that the necrotic and fluorescing areas correspond.

Microscopic sections of all tumors showed the presence of irregular areas of necrosis. Fig. 1b shows the area of fluorescence observed in one tumor; Fig. 1a, the section made from this tumor to show the essential identity of the area of fluorescence and the area of necrosis.

It is apparent from these data that the distribution of fluorescein in sarcoma 180 after a constant intravenous dose is determined by the length of time between injection and observation and by the amount of necrosis; at the longer durations the fluorescence was thus observed predominantly or only in the areas of necrosis. These results suggest that, in these tumors at least, a major factor determining the distribution of fluorescein in the tumors at any given time after injection is the slowness of diffusion into and out of poorly vascularized or necrotic areas.

Relative staining of viable and nonviable portions of tumors with fluorescein must thus be considered a dose-duration phenomenon, rather than the result of any specific staining potentiality of either portion.

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Physiological Adjustments in Chloride Balance of the Goldfish

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Absorption of certain ions, particularly chloride and sodium against an osmotic gradient, by the gills of certain fresh-water fishes was demonstrated by Krogh (*1*). The goldfish proved to be a favorable subject for these experiments, but in the case of chlorides, at least, Krogh (*2*) states that the body must be depleted below normal ion concentration of the internal medium before absorption occurs. He accomplished this by leaching the chlorides from the fish with distilled water. However, there are no quantitative studies showing that an initial reduction of the chloride level is necessary to evoke absorption of this ion. In the present studies data were obtained upon this phase of the chloride problem.

Vigorous goldfish (body weight, 45–95 gm) from a commercial hatchery which had been kept for at least 5 days without food in tanks of flowing water were used. Throughout the experiments each fish was held in a glass battery jar containing a carefully measured volume of tap water aerated continuously with washed, compressed air. In those situations in which it was necessary to separate the activity of the gills from that of the kidneys, a thin rubber sack was slipped over the tail of the fish and brought forward to the level of the pectoral fins, where it was bound snugly to the fish with cotton thread. Preliminary experiments had shown that this procedure did not interfere with equilibrium or locomotion of the fish. The urine and feces formed were collected in the rubber sack, but since the fish were in a fasting state, the material from the alimentary tract was negligible. The movements of the chloride ions were determined by analyses of the water surrounding the fish

and of the urine collected in the rubber sack. The electrometric titration of chlorides was followed, employing the electrode system of Yeck and Kissin (*4*).

Using a series of 80 goldfish, 164 determinations of the chlorides in the water surrounding the individual fish over periods ranging from 20 min to 117 hrs were made. The data have been summarized in Table 1. These fish

TABLE 1

LOSS OF CHLORIDES FROM AND ABSORPTION BY THE GILLS OF GOLDFISH

Duration of experiment	No. of determinations	Mg of chloride/gm of body weight lost (−) or absorbed (+) by the fish	
		Range	Mean
20–60 min	11	0.000 to −0.035	−0.019
4– 6 hrs	27	0.000 to −0.097	−0.033
23–24 "	39	−0.027 to +0.296	+0.144
44–52 "	78	+0.105 to +0.928	+0.375
72 "	3	+0.647 to +0.920	+0.805
96 "	3	+0.650 to +1.010	+0.850
117 "	3	+0.600 to +0.935	+0.798

were taken directly from the concrete holding tank, the rubber sack secured around the posterior portion of the body, and the individual fish placed in the experimental jar without further treatment.

Within the first 20 min there was an appreciable loss of chloride ion from the fish into the surrounding water. This loss continued at a diminishing rate for 4–6 hrs, at which time the absorption of chlorides was begun. With few exceptions, all the chloride lost by the fish into the water had been regained and additional chloride absorbed by the end of 24 hrs. In the period between 24 and 48 hrs the chloride concentration of the water surrounding the fish was markedly reduced. In several cases as much as 34 mg of chloride was absorbed by individual fish, and the concentration of that ion reduced in the water to 0.006 mM/liter. In most cases, by the end of 48 hrs the chloride content of the water was reduced so low that the experiment was terminated. However, in three cases, sodium chloride was added to the water and the absorptive process followed for 117 hrs. The chloride uptake by the fish continued through 72 hrs, leveling off at 96 hrs and dropping slightly at 117 hrs.

In this series it is evident that both the initial loss of chloride by the fish and the subsequent absorption of chloride from the surrounding water were accomplished via the gills, as all of the urine and any material voided from the alimentary canal were caught in the rubber sack. In view of other experimental work it is highly improbable that any chlorides were absorbed from the rubber sack through the unbroken and uninjured integument of the fish.

Another lot of 36 fish was divided into three groups, each fish of one group receiving by intraperitoneal injection 2.5 ml of glass-distilled water and each fish of the second group, 2.5 ml of a sodium chloride solution carrying 50 mg of the chloride ion. The third group consisted of uninjected controls.

The chloride determinations on both the surrounding water and the urine in the rubber sacks were made at the end of 48 hrs. The data are given in Table 2.

TABLE 2

EFFECTS OF INJECTIONS OF CHLORIDE OR DISTILLED WATER UPON THE CHLORIDE ABSORPTION (GILLS) AND EXCRETION (KIDNEYS) OF THE GOLDFISH AT THE END OF A 48-HR PERIOD

Groups	No. of fish	Mg of chloride/gm of fish absorbed or excreted	
		Range	Mean
Absorption			
A Controls	11	0.168 to 0.480	0.315
B Salt injection	11	0.055 to 0.433	0.189
C Distilled-water injection	14	0.184 to 0.390	0.301
Excretion			
A Controls	11	0.271 to 0.470	0.368
B Salt injection	12	0.230 to 0.550	0.361
C Distilled-water injection	13	0.160 to 0.398	0.258

Statistical significance—Absorption: A : B, $t = 2.595$, $P < 0.02$; A : C, $t = 0.407$, $P < 0.7$; B : C, $t = 2.92$, $P < 0.01$. Excretion: A : B, $t = 0.197$, $P < 0.9$: A : C, $t = 4.141$, $P < 0.001$; B : C, $t = 2.915$, $P < 0.01$. A P-value of less than 0.02 is considered to be statistically significant.

There was a statistically significant difference in absorption between the fish receiving 50 mg of the chloride ion and those receiving distilled water, the average amount absorbed being 0.189 mg/gm of body weight for the former as compared with 0.301 mg/gm for the latter group. There was no significant difference between the absorption of chloride by the uninjected controls and the distilled-water group. On the other hand, excretion of chloride ion was reduced in the fish receiving the distilled-water injection, the average being 0.258 mg/gm as compared with 0.368 mg/gm for the salt-injected fish and 0.361 mg/gm for the uninjected controls. This difference was also statistically significant.

It is apparent that excitation of the fish by handling is sufficient to initiate changes in the absorptive mechanism, the fish first losing chlorides from the gills, before the absorption began. Krogh (*1*) states that goldfish would not absorb chlorides immediately when placed in an experimental chamber, but his "washing out" technique obscured the fact that a preliminary loss of this ion occurred as a result of excitement. These reactions of the goldfish are suggestive of the adaptation syndrome of Selye (*3*).

The initial loss of chlorides from the gills during the first 4 hrs of these experiments amounted to about 3% of the entire quantity of that ion present in the body of

the fish. This loss, if there were no compensation from the tissues, would lower the blood chlorides only from ca. 440 mg% to 427 mg%—relatively a very small change, for both of these values lie within the range of normal blood chlorides for the goldfish. It is uncertain whether this constitutes sufficient depletion to activate the chloride-absorbing mechanism, but it is evident that once the absorption was begun, reducing the chloride concentration of the body (by dilution) tends to retard excretion of the ion rather than to accelerate absorption. Conversely, increasing the chloride concentration of the body fluids (by injecting NaCl) retards absorption but does not increase the rate of excretion.

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Transmission by Leaf Hoppers of the Virus Causing Phloem Necrosis of American Elm

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Phloem necrosis, a virus disease, is one of the most destructive diseases affecting the American elm. Its origin is unknown, although observations and reports by Garman (*5*) and Forbes (*4*) indicate its presence in the Ohio River Valley as early as 1882. In recent years this disease has become epidemic in many sections and has destroyed thousands of valuable shade trees in such cities as Columbus and Dayton, Ohio; Peoria, Illinois; and St. Louis and Kansas City, Missouri. It has become widespread and is now known to occur in Ohio, Indiana, Illinois, Missouri, Iowa, Nebraska, Kansas, Oklahoma, Arkansas, Mississippi, Tennessee, Kentucky, and West Virginia (*1*).

In 1940 the Bureau of Entomology and Plant Quarantine, in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering, established a laboratory at Columbus, Ohio, for the purpose of studying the disease and determining the possible insect vectors of the virus. This paper reports briefly transmission studies with some of the insect species under investigation.

Late in August and early in September 1940, some adults of the leaf hopper genus *Erythroneura* were collected from elm in the Columbus area and confined for 4 days in cloth sleeves placed over the foliage of diseased elm trees. After this period of feeding the insects were divided into two lots and placed in two cloth-covered cages (6′ × 6′ × 9′), each of which contained 4 healthy elm seedlings of approximately ¾″ caliper. The insects were not disturbed again and were left to feed until they died. The cages containing the seedlings were kept covered during the active insect seasons through 1942. No disease symptoms having developed meanwhile, the cages were then removed and the trees left to grow unprotected thereafter. Each succeeding year the trees were examined for signs of disease. In August 1945, 3 of the 8 trees showed typical symptoms of phloem necrosis. Two of these died the same summer, and the third died early the following spring. The other 5 have remained healthy to date.

Further extensive tests with this group of leaf hoppers were established after the trees had developed symptoms of disease in 1945 and are now under way, but it will be some time before they will be completed. The results of the tests begun in 1940 are being reported, however, because they indicate that transmission was accomplished by insects in this genus. In addition to the three trees that died, only one tree among several thousand in the immediate vicinity has become diseased since 1940 without previous inoculation by diseased tissue grafting. The exception is a tree that grew in a cage adjoining the one in which two of the three died, the two cages having one cloth wall in common.

The *Erythroneura* specimens used in the tests begun in 1940 could not be recovered for identification, and the species involved remain unknown. More than one species probably was confined in each cage; yet the chances are that most of them were of the species *campora*, which is known to have been common in the collection area in 1940. This species occurs commonly on elm and doubtlessly is distributed throughout the disease region.

In early surveys of elm insects in the disease region several species of the leaf hopper genus *Scaphoideus* were collected. One of these, *S. luteolus* Van D., is a consistent inhabitant of elm. This species, although difficult to separate from closely allied ones in the adult stage, was found to differ markedly from others in the nymphal stages. This difference facilitated collection and permitted the establishment of a large series of transmission tests with this elm-inhabiting species from 1941 through 1943. The species was not used in tests in 1944, and only a few nymphs were used in 1945. In July 1946, however, a small number of nymphs were collected and, after they had fed for various periods on diseased elm foliage, were placed under test on healthy one-year-old American elm seedlings. On July 12, 2 seedlings were exposed to nymphs and adults that had fed the previous 9 days on diseased elm foliage; on July 15, 5 seedlings were exposed to nymphs that had fed the previous 12 days; and on July 26, 2 seedlings were exposed to nymphs and adults that had fed the previous 3 days. In all cases the infective insects were left on the test seedlings until the insects died. When all were dead, the seedlings were placed in a

[1] D. E. Parker supervised these investigations, H. T. Osborn conducted the laboratory tests prior to 1944, and R. U. Swingle, of the Bureau of Plant Industry, Soils, and Agricultural Engineering, gave valuable assistance in early diagnostic work.

cloth-covered cage and sprayed with DDT as an additional precaution against possible contamination by unwanted insects.

Symptoms of phloem necrosis are seldom visible prior to mid-June. In late June 1947, therefore, all test trees were checked routinely for the possible appearance of disease. At this time one of the two seedlings placed under test on July 12, 1946, showed typical symptoms of phloem necrosis, and by August 1 the foliage was dead. The seedling was then removed and examined. Near the ground line, in certain portions of the phloem still alive, the symptoms were pronounced. Before this seedling was discarded, three patches of bark were removed and grafted into three healthy seedlings to determine whether the virus could be transmitted from the test seedling. In October one of these seedlings showed early symptoms of phloem necrosis. This seedling was then removed to a propagation room inside the laboratory, where it continued to grow until early in January 1947, when its foliage suddenly died. At this time the seedling showed typical late-stage symptoms of phloem necrosis.

On July 2, 1947, one of the seedlings placed under test on July 26, 1946, was found to have died so suddenly that its leaves had failed to abscise and still hung on—a phenomenon by no means uncommon among naturally infected trees growing in the open. Examination of the inner phloem of this seedling revealed typical phloem necrosis discoloration. These test trees developed symptoms, therefore, in less than a year after being exposed to infective insects. This period contrasts strikingly with a possible inoculation period of 5 years where species of *Erythroneura* were used.

The evidence favors transmission of the virus by this species of *Scaphoideus*, whereas transmission by species of *Erythroneura* is more doubtful. Among several hundred other test trees in the same and adjoining cages and among several thousand trees in a nearby nursery, there exists as yet no other evidence of insect transmission of the virus. As a further check on the significance of the results obtained with *Scaphoideus*, however, an extensive series of tests was established late in the 1947 season, but it is too early to report on these tests.

The individuals of *Scaphoideus* used in the 1946 tests were recovered and, after the development of disease symptoms in the test trees in 1947, were forwarded to the Division of Insect Identification. According to P. W. Oman, all were found to belong to the single species, *Scaphoideus luteolus* Van D. Oman's determination of these specimens was based on specimens compared with the type of *luteolus*. They therefore are not the same, according to him, as the species that DeLong (*2*) described as *luteolus*, but are the same as the species DeLong and Mohr (*3*) described as *baculus*. *Scaphoideus luteolus* is widespread throughout the region where phloem necrosis occurs, having been taken in surveys from Ohio on the east, to Kansas on the west, and to Jackson, Mississippi, on the south. That this species occurs in regions not yet known to harbor the virus is demonstrated by Oman's statement accompanying the determination, in which he reports having seen specimens from the following states outside the disease area: New Jersey, New York, Pennsylvania, Maryland, Virginia, Georgia, and Alabama.

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The Mechanism of Cysteine and Glutathione Protection Against Alloxan Diabetes

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Stanley Levi

Department of Physiological Chemistr
Wayne University College of Medici

The suggestion that alloxan may produce diabetes b cause of inactivation of essential sulfhydryl enzymes the beta cells of the pancreas was made in an earli paper by Lazarow (*5*). Inasmuch as large doses alloxan also destroy other cells (liver, kidney, etc.), also was postulated that the selectivity of this compou for the beta cells might be due to an especially lo glutathione content which rendered the beta cells mo susceptible to alloxan (*5*).

The injection of large doses of glutathione, cystein thioglycolic acid, and BAL protected rats against a di betogenic dose of alloxan (*5*, *6*). By contrast, lar doses of alanine, methionine, thiourea, and other co pounds did not modify its diabetogenic effect. Prote tion against diabetes by these sulfhydryl compoun occurred only when they were given prior to the di betogenic dose of alloxan. When glutathione or BA was given 5 min after a diabetogenic dose of alloxa no protection occurred. Since protection failed to occ when the sulfhydryl compound was given after t alloxan, it was suggested that, if the diabetogenic acti of alloxan were due to a combination with essenti sulfhydryl groups of enzymes, this reaction would n be as readily reversed as would be the case if the S groups of the enzymes were simply oxidized to SS group However, a combination of alloxan with the SH group would explain the failure to protect against diabet when the sulfhydryl compound was given following t diabetogenic dose of alloxan.

Inasmuch as alloxan, dialuric acid (reduction produ of alloxan), and derivatives of these compounds are u stable, the ultraviolet absorption spectra method w considered suitable for studying the possible reactio of alloxan with sulfhydryl molecules. This necessitate the study of the absorption spectra of alloxan and di

uric acid, which previously were reported as having no xima (*4*).

By methods which will be published in detail at a ture date, it was found that alloxan showed an in- tion at 270 mμ (ε about 90) below pH 5.0 and an flection which became a maximum at 245 mμ as the pH raised above pH 6.0–7.4 (ε = 4,800 at pH 7.4). The composition of alloxan at pH 7.4 was found to be a t-order reaction, the half-life of alloxan being just der 1 min at 37° C and about 2 min at room tempera- ure. Below pH 5.0 alloxan was relatively stable.

Dialuric acid showed a maximum at 270 mμ (ε = 3,200) 1% HCl and at 275 mμ (ε = 16,500) at pH 7.4. Dia- ic acid is oxidized rapidly by air in dilute solution but be stabilized by the addition of cysteine.

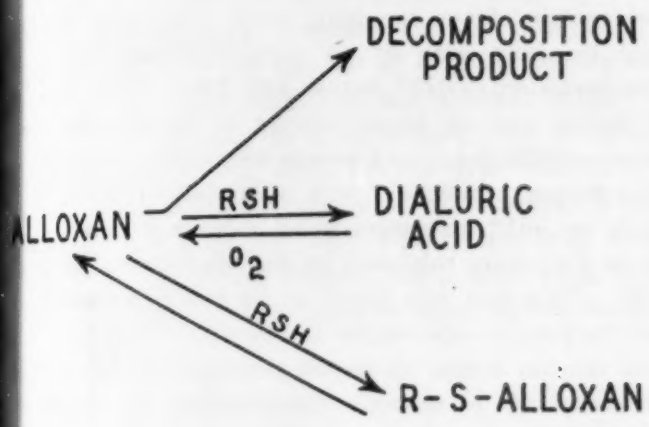

FIG. 1

Alloxan was found to react with cysteine to give a ectrum similar to that found when dialuric acid was bilized with cysteine. With time, at pH 7.4 both dia- ic acid and alloxan decomposed in the presence of teine, and a broad band appeared between 340 and mμ (ε = 50–650, depending on conditions).

Alloxan reacted with glutathione to give maxima at mμ and 305 mμ. The maximum at 275 mμ was erved with a high glutathione to alloxan ratio (9: alloxan = M/5,000). On standing, the maximum at mμ disappeared, whereas that at 305 mμ became more ense (ε = 17,400). When equimolecular proportions of xan and glutathione were mixed (M/5,000), a maxi- m at 305 mμ was observed. In 3 min the extinction 305 mμ reached 75% of the highest extinction obtained this ratio.

Dialuric acid and glutathione gave essentially the same l result as did alloxan and glutathione. Oxidized tathione did not react with alloxan. Alloxan (or dia- ic acid) reacted much more slowly with glutathione in presence of cysteine, to give a maximum at 305 mμ, n was the case when cysteine was absent.

Alloxan added to crystalline egg albumin, denatured th "Duponal P.C." to free the sulfhydryl groups, gave pectrum with a maximum at 305 mμ. The spectrum determined by comparing with a blank containing protein and Duponal.

The data presented suggest the following conclusions, ich are illustrated in Fig. 1.

Alloxan is rapidly decomposed at pH 7.4. It is also reduced to dialuric acid by sulfhydryl compounds. With alloxan and glutathione (as compared with cysteine), the formation of a maximum at 305 mμ is striking, and is thought to be due to formation of an addition product which would appear to be similar to that described by Schubert (*8*) in his study of the reaction of carbonyl groups with sulfhydryl. Since the addition of cysteine will convert alloxan to dialuric acid, the fact that added cysteine slows down the formation of a product with an absorption spectrum maximum at 305 mμ indicates that the mechanism involves a reaction of glutathione with alloxan rather than with dialuric acid. Since oxidized glutathione fails to react, the addition product is believed to take place through the sulfhydryl group of the glutathione.

The mechanism by which cysteine protects against alloxan diabetes is probably due to the reduction of alloxan to an nondiabetogenic compound, dialuric acid. Although dialuric acid can be reconverted to alloxan, this reconversion is also slowed by cysteine, thus preventing the formation of an effective concentration of alloxan. In addition, glutathione removes alloxan from the field of action by forming a new compound with an absorption spectrum maximum at 305 mμ. These results might explain why the administration of a large dose of sulfhydryl, given 5 min after a diabetogenic dose of alloxan, fails to protect rats from diabetes. For, if the alloxan has already reacted with proteins as indicated in the data (presumably with the sulfhydryl groups of essential enzymes), the addition of sulfhydryl might not be expected to reverse this reaction. The data also support the contention that dialuric acid itself is not diabetogenic, but that the diabetes observed after the injection of dialuric acid (*1*) is due to the conversion of dialuric acid to alloxan in the body.

Since it has been reported that an enzyme contained in dog liver can convert uric acid into dialuric acid (*7*), and since the injection of dialuric acid produces diabetes, presumably by conversion to alloxan, there is a reasonable chance that alloxan may also occur in man (*2*).

In a preliminary note Griffiths claimed the production of diabetes by the injection of massive doses of uric acid into a glutathione-depleted rabbit (*3*).

Should alloxan prove to be a factor in human diabetes, the reaction between glutathione and alloxan herein reported would have an important bearing on its etiology and prevention.

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IN THE LABORATORY

Adaptation of Selsyn Transmitters for Obtaining Isometric Myographs on the Cathode-Ray Oscilloscope

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A method by which inexpensive, readily available, 400-cycle, selsyn transmitters may be used for obtaining mechanical myographs on the cathode-ray oscilloscope is as follows:

The rotor leads of a small indicator-type selsyn transmitter are connected to any convenient source of audiofrequency alternating current, which need be only a moderately good sine wave with an output of 10–30 v and capable of working into the low impedance of the rotor winding. A few watts of power is ample. Any pair of the three stator leads is then connected through the amplifier of a conventional cathode-ray oscilloscope.

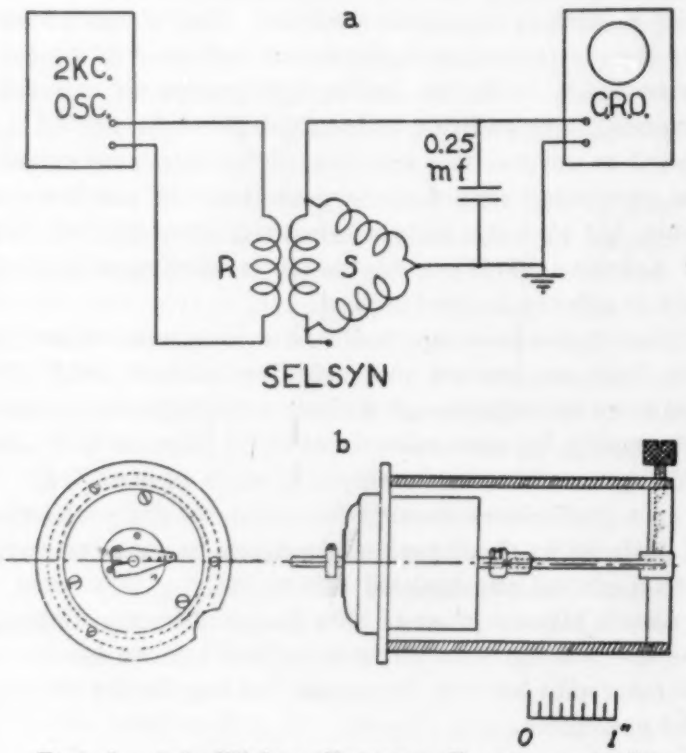

FIG. 1. (a) Wiring diagram: R—rotor winding, S—stator windings; one lead left unattached. (b) Selsyn pick-up unit showing the added lever, cylindrical case, and torsion spring. The knurled screw is used for adjusting the zero load output level.

The pattern is observed on the oscilloscope and the rotor turned until minimum output is obtained. The gain of the oscilloscope can now be turned up without appreciably increasing the output. At this point it is noted that a minute amount of rotation of the shaft produces a marked increase in output. The use of a condenser of suitable size (0.25 mf for 2,000 cps or 1 mf for 1,000 cps) (Fig. 1a) will greatly improve the sensitivity and linearity of the rotation to output changes.

A unit wired as described was arranged with a short lever attached to the front shaft and with a short length of spring steel rod attached axially to the rear shaft and fixed at the other end to the case of the instrument (Fig. 1b). With the spring in place a small load applied to the lever produces torsional stress on the spring, and the electrical unbalance appears as a departure from the zero level. The unit described used the long limb of an Allen-head setscrew wrench that measured 0.078″ across the flats. With this type of spring and an input voltage of 30 at 2,000 cps a torque of 125 gram-centimeters produced a 0.13-v change. This torque produced 7 min of angular rotation of the shaft or .001″ displacement of a lever ½″ long. Loads up to 3 kg were tolerated by the shaft and lever system used. This unit was found to have adequate sensitivity and frequency response for the isometric recording of the time tension course of muscle responses to single shocks. Linearity of force and displacement to output was within 2% over wide ranges.

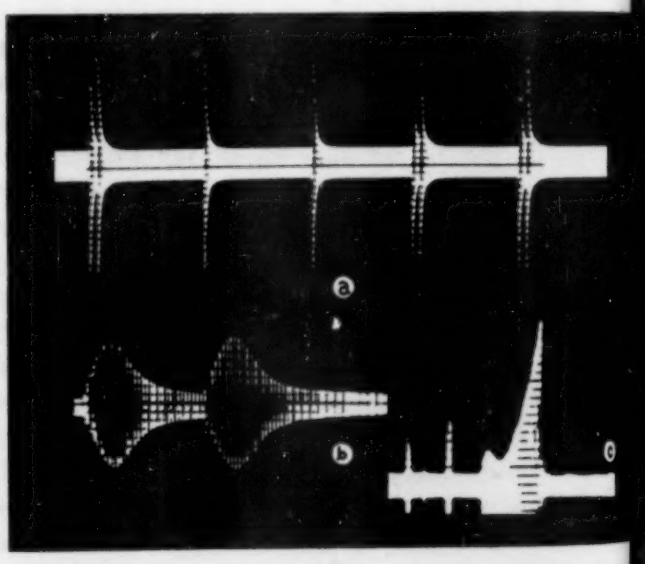

FIG. 2. (a) Isometric twitch responses of rat gastrocnemius muscle-nerve preparation to single and dual shocks. Stimuli at 1-sec intervals. Slow-moving film record with oscilloscope sweep off. Oscilloscope grid lines divide the pattern for easy measurement. (b) Twitch response of human hypothenar muscles to two stimuli delivered percutaneously to the ulnar nerve. Single sweep photographed on stationary film. (c) Slow-moving film record of sudden release of 2 kg load to show rapidity of response and damping. All curves taken with exciting oscillator at 500 cps.

The oscilloscope pattern observed is that of an amplitude-modulated audiofrequency signal (Fig. 2a). The outline of one-half of the modulation envelope is a conventional myograph curve, but the double curve

vantageous in making accurate measurements. Since amplitude of the audiofrequency signal is changed the deflecting force, the base line reflects changes in signal source and the position of the rotor. Direct-rent amplification is not required to obtain static d characteristics and calibration can be easily ob-ined by the use of laboratory weights hung on the r arm.

The frequency of the oscillator used to power the lsyn can be used as a time signal when it is set so that the individual peaks are visibly separated by the ep speed (Fig. 2b). This is particularly advanta-s when using cathode-ray technique, since it elimin-s the requirement of additional timing systems. The tural frequency response of the device described was rmined to be 600 cps with excellent damping (Fig. Higher frequency response can be obtained by rificing sensitivity by the use of a stiffer spring and versa. The unit described has a shaft 0.125″ in meter and is not adapted to more than a few kilograms load. Larger units, such as the type GE 2J1G1, ve been tested and are capable of withstanding higher ds. The size 5 selsyn, also readily available from ny surplus equipment dealers, has a 5/16″ shaft and adapted to loads encountered in myographic observa-ns on man.

ffect of Calcium Chloride on the eparation of Extracts of *pertussis*[1]

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is well known that mucin-like substances interfere the separation and purification of tissue proteins Difficulty is also encountered in the isolation of s and other antigens from mucin-producing bacteria, the mucin-like materials hinder effective centrifuga-filtration, and washing.

ring the course of studies on the isolation and char-ization of toxic and somatic antigens from a toxin-ducing strain of *H. pertussis* (*7*), contaminating in-like substances greatly hindered all preparative edures. Sharp separation of the bacteria from their ble antigens by either centrifugation or filtration was ost impossible, and extracts prepared by either of methods were found to be unsatisfactory for further ification of the toxin. Under certain conditions, the in was strongly, and at times irreversibly, adsorbed the mucin. It was thus impossible to determine the solubility of the toxin.

It was observed that the addition of optimal amounts $CaCl_2$ to a suspension of *H. pertussis* results either in precipitation or in a physiochemical alteration of the mucin-like substances with no loss or destruction of pertussal toxin. The results of a typical experiment are given in Table 1. It will be seen that the presence of

TABLE 1

Extracting fluid	Appearance of supernatant	Mg of N/ml	MLD/ml
Distilled water	Turbid and viscous	0.72	160
0.05 M $CaCl_2$	Translucent; only slightly opalescent; straw colored	0.49	160
0.1 M $CaCl_2$	Translucent; slightly opalescent; straw colored	0.54	160

0.05 M–0.1 M $CaCl_2$ in a 2.5% suspension of *H. pertussis* gives a translucent, slightly opalescent, straw-colored solution which contains all of the toxin originally present in the suspension. Furthermore, it will be noted that the nitrogen content of these $CaCl_2$ extracts is considerably lower than that of the aqueous extract, indicating that the elimination of nitrogenous impurities is also achieved at this step.

Removal or alteration of the mucin greatly influences the solubility of the toxin in methanol-water mixtures under controlled conditions of pH, ionic strength, and temperature (*2–6*). In aqueous extracts, the toxin is insoluble between pH 4.0 and 4.8 at low ionic strength and is highly soluble at hydrogen ion concentrations below pH 5. All precipitates are mucilaginous and dissolve with great difficulty in either water or salt solutions. In $CaCl_2$ extracts, on the other hand, the toxin is soluble between pH 4 and 5, but is quantitatively precipitated between pH 5 and 6.4 under appropriate conditions of methanol concentration, temperature, and ionic strength. These precipitates are flocculent and dissolve readily in salt solutions.

While every protein or bacterial suspension will present a new problem, it is possible that the controlled use of multivalent cations or anions will be of aid in the removal of mucin-like contaminants from other proteins which require purification and characterization. Work is in progress in this laboratory on the mechanism of the effect of $CaCl_2$ and on the influence of inorganic salts containing multivalent cations and anions on other protein systems.

[1] Aided by a grant from the Lederle Laboratories Division, erican Cyanamid Company.

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